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Space Weather Monitoring for ISS Space Environments Engineering and Crew Auroral Observations

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The International Space Station (ISS) space environments community utilizes near real time space weather data in support of a variety of ISS engineering and operations activities. The team has operated the Floating Potential Measurement Unit (FPMU) suite of plasma instruments (two Langmuir probes, a floating potential probe, and a plasma impedance probe) on ISS from 2006 to the present time to obtain in-situ measurements of plasma density and temperature along the ISS orbit and variations in ISS frame potential due to the combined effects of electrostatic current collection processes from the plasma environment and inductive (vxB) effects due to the motion of the vehicle across the Earth's magnetic field. An ongoing effort to use FPMU for measuring the ionospheric response to geomagnetic storms at ISS altitudes and document ISS frame charging as the vehicle passes through regions of precipitating auroral electrons is challenged by restrictions on the available FPMU operation time. The instruments can only be operated during campaign periods limited to about a third of a year in accumulated operation time and FPMU data is down linked through the ISS Ku band telemetry system, a shared resource. As a result, FPMU campaign periods of a few days to weeks have typically been scheduled for periods of a week or two in advance. Capturing geomagnetic storm data under these conditions depended on the fortuitous event of a storm starting during a previously planned FPMU campaign period, an unlikely event at a time when Solar Cycle 24 was ending and a protracted solar minimum gave little in the way of geoeffective solar disturbances. However, with the start of Solar Cycle 24 the number of solar disturbances and associated geomagnetic storms started to increase and we modified our strategy to improve the chances of capturing geomagnetic storm data. We now monitor near real time space weather data from NASA, NOAA, and ESA sources to determine solar wind disturbance arrival times at Earth likely to be geoeffective (including coronal mass ejections and high speed streams associated with coronal holes) and activate the FPMU ahead of the storm onset. Using this technique we have now been successful in capturing FPMU records from a number of geomagnetic storm periods including variations in ISS frame potential at high latitudes associated with geomagnetic activity that we interpret as auroral charging. In addition, space weather summaries were provided to ISS Expedition 30/31 crew along with predictions for upcoming auroral activity and estimates for times the ISS orbit would pass through regions of high magnetic latitude to enhance crew opportunities to image aurora from the ISS. This presentation will describe the near real time space weather resources utilized to predict FPMU operation times, summarize the results from FPMU operations during the geomagnetic storm periods, and provide examples of auroral images obtained by the ISS crew during recent storm periods from the spring and summer of 2012.